DECLARATION

In re the application of
Atsushi Sone et al
Serial No. 10/562,567
Filed: December 27, 2005

Art Unit: 1773
Primary Examiner:
Vivian Chen

For: Optical Multilayer Film, Polarizing Plate and Optical Product

DECLARATION UNDER 37 C.F.R. 1.132

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

I, Atsushi Sone, of c/o Zeon Corporation, 6-2, Marunouchi 1-chome, Chiyoda-ku, Tokyo, 100-8246 Japan, being duly sworn, declare and state:

THAT I am by profession a research chemist having been awarded a master's degree on the paper "Synthesis of Resist Material for Macrolithography" from the post-graduate course of Faculty of Polymer Chemistry, the Department of Technology, Yamagata University, Japan in March, 1992.

THAT I have been employed since April, 1992 by Zeon Corporation of 6-2, Marunouchi 1-chome, Chiyoda-ku, Tokyo, 100-8246 Japan and engaged in research in the Research & Development Center of the same company mainly on:

development of resist material, especially KrF resist and ArF resist from April 1992 to February 1998;

development of speciality plastics, especially cycloolefin polymers from March 1998 to July 2002; and

development of optical goods, especially light diffusion panels, hard coating liquid, LR liquid and optical films from August 2002 up to now.

THAT I am a co-inventor of the invention disclosed in the

above-identified U.S. patent application (hereinafter referred as "present invention" for brevity) and hence I am fully familiar therewith.

THAT, to show that the benefits of the present invention can be obtained when the low refractive layer is comprised of a porous body having hollow particles dispersed in a matrix, I have conducted additional experiments, which are shown below as Examples 5 and 6, and Comparative Examples 4 and 5.

ADDITIONAL EXPERIMENTS

Example 5

21 parts of an oligomer of tetramethoxysilane, 36 parts of methanol, 2 parts of water and 2 parts of an aqueous 0.01N hydrochloric acid solution were mixed together and the mixture was stirred for 2 hours at 25°C in a thermostat to give a silicone resin having a weight average molecular weight of 850. Then, a sol of hollow fine silica particles in isopropanol (solid content: 20%, average primary particle diameter: about 47 nm, outer shell thickness: about 7 nm) was added to the silicone resin at a mixing ratio such that the solid content ratio of hollow fine silica particles/silicone resin (as expressed in terms of the condensed compound) was 8/2 by mass. The thus-obtained mixture was diluted with methanol to give a silicone alkoxide solution having a total solid content of 1%.

The same hard coat layer-laminated film 1C as prepared in Example 1 was coated on its hard coat layer side with the above-mentioned silicone alkoxide solution by a micro-gravure coater, and the thus-formed coating was heated at 120°C for 5 minutes to form a low refractive index layer having a thickness of 100 nm. The thus-obtained laminated film 1a having the low refractive index layer had a refractive index of 1.29. Parts of the laminated film 1a were cut therefrom to evaluate abrasion resistance and void volume % of the low refractive index layer.

A polarizing plate 1b having a low refractive index layer was made by the same procedures as described in Example 1 except that the remainder of laminated film 1a was used instead of the laminated film 1D with all other procedures remaining the same. Using the polarizing plate, light reflectivity, contrast and

visibility were evaluated. The results are shown in Table I.

Example 6

A laminated film 2a having a low refractive index layer was made by the same procedures as described for the preparation of the laminated film 1a in Example 5 except that a silicone alkoxide solution was obtained from a mixture of a hollow fine silica particle sol with the silicone resin wherein the mixing ratio was such that the solid content ratio of hollow fine silica particles/silicone resin (as the condensed compound) was 7/3 by mass instead of 8/2 by mass. All other procedures remained the same.

The laminated film 2a had a refractive index of 1.33. Parts of the laminated film 2a were cut therefrom to evaluate abrasion resistance and void volume % of the low refractive index layer. A polarizing plate 2b was made by the same procedures as described in Example 5 except that the remainder of laminated film 2a was used instead of the laminated film 1a with all other procedures remaining the same. Using the polarizing plate, optical characteristics were evaluated. The results are shown in Table I.

Comparative Example 4

A laminated film 3a having a low refractive index layer was made as follows. 21 parts of tridecafluorooctyl-trimethoxysilane, 36 parts of methanol, 2 parts of water and 2 parts of aqueous 0.01N hydrochloric acid solution were mixed together and the mixture was stirred for 2 hours at 25°C in a thermostat to give a silicone resin having a weight average molecular weight of 900. Then, a sol of hollow fine silica particles in isopropanol (solid content: 20%, average primary particle diameter: about 15 nm, outer shell thickness: about 4 nm) was added to the silicone resin at a mixing ratio such that the solid content ratio of hollow fine silica particles/silicone resin (as expressed in terms of the condensed compound) was 8/2 by mass. The thus-obtained mixture was diluted with methanol to give a silicone alkoxide solution having a total solid content of 1%.

The same hard coat layer-laminated film 1C as prepared in Example 1 was coated on its hard coat layer side with the above-mentioned silicone alkoxide solution by a micro-gravure coater, and the thus-formed coating was heated at 100°C for 5

minutes to form a low refractive index layer having a thickness of 100 nm.

The thus-obtained laminated film 3a having the low refractive index layer had a refractive index of 1.22. Parts of the laminated film 3a were cut therefrom to evaluate abrasion resistance and void volume % of the low refractive index layer. A polarizing plate 3b was made by the same procedures as described in Example 5 except that the remainder of laminated film 3a was used instead of the laminated film 1a with all other procedures remaining the same. Using the polarizing plate, optical characteristics were evaluated. The results are shown in Table I.

Comparative Example 5

A laminated film 4a having a low refractive index layer was made by the same procedures as described for the preparation of the laminated film 1a in Example 5 except that a silicone alkoxide solution was obtained from a mixture of a sol of hollow fine silica particles in isopropanol (solid content: 20%, average primary particle diameter: about 30 nm, outer shell thickness: about 8 nm) with the silicone resin wherein the mixing ratio was such that the solid content ratio of hollow fine silica particles/silicone resin (as the condensed compound) was 5/5 by mass instead of 8/2 by mass. All other procedures remained the same.

The laminated film 4a had a refractive index of 1.39. Parts of the laminated film 4a were cut therefrom to evaluate abrasion resistance and void volume % of the low refractive index layer. A polarizing plate 4b was made by the same procedures as described in Example 5 except that the remainder of laminated film 4a was used instead of the laminated film 1a with all other procedures remaining the same. Using the polarizing plate, optical characteristics were evaluated. The results are shown in Table I.

Determining Methods

The methods for determining the characteristics of laminated films and the optical properties of polarizing plates were the same as described in the specification of the above-identified U.S. patent application. However, the abrasion resistance of laminated films and the void volume %

of low refractive index layers were determined by the following methods.

(1) Abrasion Resistance

A pad of steel wool #1000 imposed with a load of 0.025 MPa was moved forth and back alternately, each 10 times, on the surface of the low refractive index layer side of each laminated film. Then the state of surface was observed by the naked eyes, and evaluation results were expressed by the following three ratings.

A: No scuff mark was observed
B: Scuff marks were slightly observed
C: Scuff marks were observed

(2) Void Volume %

A photograph of the cross-section of each laminated film was taken, and the cross-sectional image was processed and the average diameter of voids was determined by a statistical method. The void volume % was calculated from the ratio in area of the voids to the total area of the cross-section, and the void diameters. This determination was conducted on 10 points arbitrarily selected on the cross-section, and the average void volume % was adopted as the void volume %.

For comparison, the factual data for Examples 1-4 and Comparative Examples 1-3, shown in Table 1 of the above-identified U.S. patent application are also shown in Table I.

As seen from the comparison of Examples 5 and 6 with Comparative Examples 4 and 5, if the refractive index n_L of the low refractive index layer is too small, e.g., 1.22, abrasion resistance is very poor (Comparative Example 4). Thus it is to be noted that the refractive index n_L of the low refractive index layer influences not only upon the optical properties, but also upon the abrasion resistance. In contrast, if the refractive index n_L of the low refractive index layer is too large, e.g., 1.39, visibility and contrast are poor (Comparative Example 5).

Table I

	Examples						Comparative Examples				
	1	2	3	4	5	6	1	2	3	4	5
Base film	1A	2A	3A	4A	1A	1A	1A	1A	1A	1A	1A
Refractive index of hard coat layer	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.52	1.62	1.62
Formation of porous material *1	Drying	Drying	Drying	Drying	H.P.	H.P.	Drying	Drying	Drying	H.P.	H.P.
Refractive index of low refractive index layer	1.33	1.33	1.33	1.33	1.29	1.33	1.39	1.40	1.45	1.22	1.39
Void volume (%)	30	30	30	30	27	24	15	<10	<10	33	<5
Light reflectivity (%) at 550 nm	0.54	0.55	0.56	0.55	0.20	0.54	1.35	1.52	2.60	0.15	1.30
Light reflectivity (%) at 430–700 nm	1.1	1.4	1.3	1.3	0.9	1.1	2.0	2.2	3.2	1.6	1.9
Visibility	A	A	A	A	A	A	C	C	C	A	B
Contrast	300	280	280	300	350	300	150	100	70	310	150
Abrasion resistance	A	A	A	A	A	A	A	A	A	C	A

*1 Formation of porous material: Drying: Drying under supercritical conditions, H.P.: Hollow fine particles

I, the undersigned declarant, declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001, of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

This thirtieth day of November, 2006

Atsushi Sone

Atsushi Sone